

**Remarks**

Claims 36-59 and 61-65 are pending in the Application.

Claims 36-59 and 61-65 are rejected.

Claim 65 is cancelled herein.

**I. CLAIM REJECTION UNDER 35 U.S.C. § 112, ¶ 2**

Examiner has rejected Claim 62 under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. Examiner contends that “It is unclear what “portion” in the phrases “the first portion of the polymer” and “the second portion of the polymer” denotes.” Office Action, at 2.

Applicant respectfully traverses the rejection and submits that the word “portion” is used with its common meaning, *i.e.* “a section of a larger piece” or “part of a whole.” This meaning is consistent with the definition for “portion” given in “The American Heritage Dictionary,” Second College Edition, Houghton Mifflin Company, 1982, page 966. (*See Exhibit A*)

Moreover, Claim 62 is dependent upon Claim 61. Claim 61 was amended for clarity and to provide antecedent bases for dependent claims in the Applicant’s reply to the first Office Action having a mailing date of March 22, 2005 (the “March 22, 2005 Office Action”). In that reply, Claim 61 was amended to state:

61. A composition of matter in accordance with claim 45, wherein a first polymer that coats a first portion of the aggregate of the uncoated single-wall carbon nanotubes is cross-linked with a second polymer that coats a second portion of the aggregate of the uncoated single-wall carbon nanotubes.

(*See March 22, 2005 Office Action, at 5 (underlining in the original)*)

Moreover, more than one polymer can coat the same aggregate, *i.e.*, one polymer can coat a first portion, or part, of the aggregate of the uncoated single-wall carbon nanotubes and another polymer can coat a second portion, or part, of the aggregate of the uncoated single-wall carbon

nanotubes.

For example, see Figure 2A in the Application and observe how wrapping of several different polymers can be manifested on different portions of a single-wall carbon nanotube. In Figure 2A, the coating or wrapping on a single-wall carbon nanotube is a double helix. One strand of polymer could be a first polymer and the other could be a second polymer. Each strand of polymer is wrapping a different portion of the single-wall carbon nanotube. Such wrapping scheme also applies to coating bundles or aggregates of single-wall carbon nanotubes. Thus, Applicant asserts that Claim 62 distinctly claims the subject matter.

In light of the foregoing, Applicant respectfully requests the Examiner withdraw the rejection of Claim 62 under 35 U.S.C. § 112, ¶ 2, as being indefinite.

## **II. REJECTIONS UNDER 35 U.S.C. §102(b) AS ANTICIPATED BY DAVEY**

Examiner has rejected Claims 36-43, 45-59, 63 and 65 under 35 U.S.C. § 102(b) as anticipated by Davey *et al.*, European Patent EP 0 949 199 (“Davey”). Office Action, at 3.

Regarding rejections under 35 U.S.C. § 102(b), anticipation requires each and every element of the claim to be found within the cited prior art reference.

Regarding Claim 65, Applicant has cancelled this claim without prejudice. Therefore, rejection of this claim is now moot.

Regarding Claims 36-43, 45-59, and 63, Applicant respectfully traverses these rejections. Each of these claims requires single-wall carbon nanotubes, and, in particular, an aggregate of uncoated single-wall carbon nanotubes. Davey does not teach or disclose single-wall carbon nanotubes as required by Claim 36 and, accordingly, each of Claims 37-43, 45-59 and 63, which directly or indirectly depend upon Claim 36.

The distinction between single-wall and multi-wall carbon nanotubes is important because multi-wall carbon nanotubes are fundamentally different from single-wall carbon nanotubes.

Single-wall carbon nanotubes have only a single layer of  $sp^2$ -hybridized carbon atoms generally arranged in a hexagons and pentagons. Because of their single-layer, single-wall carbon nanotubes

generally cannot support defects in growth and are more susceptible to destruction by bond breakage or reaction. In contrast, multi-wall carbon nanotubes are composed of multiple, cylindrical concentric carbon layers arranged in a nested or scrolled fashion. Because of this arrangement, the carbon shells of multi-wall carbon nanotubes can withstand wall defects, which often appear as dislocations, kinks, holes, edges on the side-wall surfaces, *etc.* Also because of their multiple layers and the interconnections between these layers, multi-wall nanotubes can withstand much more rigorous chemical processing, physical conditions, and extensive chemical bond breakage without nanotube destruction compared to single-wall carbon nanotubes.

In addition, single-wall carbon nanotubes “rope” together and are held tightly by van der Waals forces. As such, the individual single-wall nanotubes are difficult to separate from each other and disperse in another media. In contrast, multi-wall carbon nanotubes generally do not rope and, therefore, are readily separable and dispersible. The structural differences between single-wall and multi-wall carbon nanotubes also lead to differences in physical and chemical properties, such as tensile strength, modulus, flexibility, thermal conductivity, electrical conductivity, chemical reactivity and chemical stability.

Besides not teaching or disclosing single-wall carbon nanotubes, *Davey* also does not teach aggregates of single-wall carbon nanotubes, as required by Claim 36 (and, accordingly, each of Claims 37-43, 45-59 and 63, which directly or indirectly depend upon Claim 36). Rather, *Davey* teaches purification of multi-wall carbon nanotubes, which do not rope or form aggregates as single-wall carbon nanotubes do. As *Davey* does not teach single-wall carbon nanotubes or aggregates of single-wall carbon nanotubes, Claim 36 and each of its dependent Claims 37-43, 45-59 and 63 cannot be held anticipated under 35 U.S.C. § 102(b) by *Davey*.

In light of the foregoing, Applicant respectfully requests that the Examiner withdraw the rejection of Claims 36-43, 45-59 and 63 under 35 U.S.C. § 102(b) as being anticipated by *Davey*.

## II. REJECTIONS UNDER 35 U.S.C. §102(b) AS ANTICIPATED BY GRIMES

Examiner has rejected Claims 36, 44 and 65 under 35 U.S.C. § 102(b) as anticipated by Grimes, *et al.* “The 500 MHz to 5.50 GHz complex permittivity spectra of single-wall carbon

nanotube-loaded polymer composites,” *Chemical Physics Letters*, 319, March 24, 2000, pp. 460-464 (“*Grimes*”). Examiner contends the “*Grimes* article teach the coating of polymer, particularly poly-ethyl-methacrylate, on a carbon single-walled nanotube.” Office Action, at 4.

Regarding Claim 65, Applicant has cancelled this claim without prejudice. Therefore, rejection of this claim is now moot.

Regarding Claims 36 and 44, Applicant respectfully traverses these rejections. Anticipation requires each and every element of the claim to be found within the cited prior art reference.

With respect to Claim 36, this claim requires “an aggregate of uncoated single-wall carbon nanotubes wrapped with one or more polymers.” *Grimes* does not teach or disclose an aggregate of uncoated single-wall carbon nanotubes that is wrapped with one or more polymers. Therefore, Claim 36 is not anticipated by *Grimes*.

With respect to Claim 44, the Examiner contends that the “*Grimes* article teach the coating of polymer, particularly poly-ethyl-methylacrylate on a carbon single-walled nanotube.” Office Action, at 4.

With respect to Claim 44, this claim states:

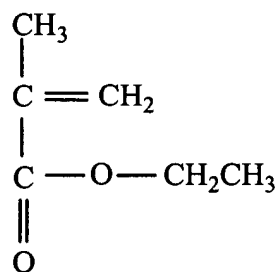
44. A composition of matter in accordance with claim 36, wherein the polymer is selected from the group consisting of: polyvinyl pyrrolidone (PVP), polystyrene sulfonate (PSS), poly(1-vinyl pyrrolidone-co-vinyl acetate) (PVP/VA), poly(1-vinyl pyrrolidone-coacrylic acid), poly(1-vinyl pyrrolidone-co-dimethylaminoethyl methacrylate), polyvinyl sulfate, poly(sodium styrene sulfonic acid-co-maleic acid), dextran, dextran sulfate, bovine serum albumin (BSA), poly(methyl methacrylate-co-ethyl acrylate), polyvinyl alcohol, polyethylene glycol, and polyallyl amine.

First, as Claim 44 depends from Claim 36, it is not anticipated for the same reasons as specified above.

Moreover, as to the limitations recited in Claim 44, *Grimes* does not teach any of the polymers recited in Claim 44. The only acrylate polymer in Claim 44 is a *copolymer*, namely poly(methyl methacrylate-co-ethyl acrylate). *Grimes* does not teach this copolymer or any copolymer. *Grimes* teaches the polymer polyethylmethacrylate, which is prepared with the monomer ethylmethacrylate. (See *Grimes*, page 461, col. 1, paragraph 2, first sentence.) This monomer is also

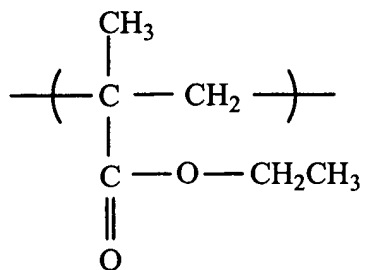
known as “2-propenoic acid, 2-methyl-, ethyl ester”; “methacrylic acid, ethyl ester,” and “ethyl, 2-methylacrylate.” The chemical structure of this monomer is as follows:

**Ethyl methacrylate monomer**



The chemical structure of the polymer poly(ethyl methacrylate) has one monomeric repeat unit and is shown as follows:

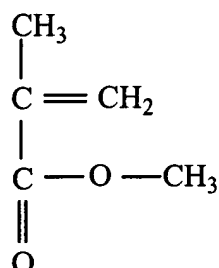
**Poly(ethyl methacrylate) repeat unit**



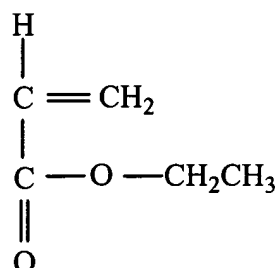
In contrast, Claim 44, requires, *inter alia*, the copolymer, poly(methyl methacrylate-co-ethyl acrylate), which is prepared with two monomers, namely, methyl methacrylate and ethyl acrylate.

The chemical structure for each monomer is provided below.

**Methyl methacrylate monomer**

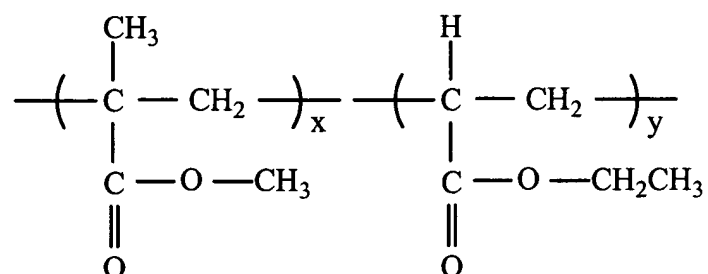


**Ethyl acrylate monomer**



The chemical structure of the polymer poly(methyl methacrylate-co-ethyl acrylate) copolymer has two different monomeric repeat units and is shown as follows:

**Poly(methyl methacrylate-co-ethyl acrylate) repeat units**



The properties of the copolymer depend on the relative amounts of the respective monomers in the polymer, as well as the distribution of each monomer in the polymer and molecular weight of the copolymer. The polymers poly(ethyl methacrylate) and poly(methyl methacrylate-co-ethyl acrylate) copolymer are different polymers and due to the unpredictability of the chemical discipline, the structural similarities of polymer cannot be used reliably to predict the properties of the other polymer.

Therefore, since the polymer poly(ethyl methacrylate) taught by *Grimes* is a completely different material than the copolymer poly(methyl methacrylate-co-ethyl acrylate), Claim 44 is not anticipated by *Grimes*.

Accordingly, Applicant respectfully requests that the Examiner withdraw the rejection of Claims 36 and 44 under 35 U.S.C. § 102(b) as being anticipated by *Grimes*.

**III. REJECTIONS UNDER 35 U.S.C. §103(a) OVER DAVEY IN VIEW OF EXAMINER'S DISCUSSION**

Examiner has rejected Claims 44 and 64 under 35 U.S.C. § 103(a) as being unpatentable over *Davey* as applied to Claims 36-43, 45-59, 63 and 65 above and further in view of the discussion below. Office Action, at 4-5.

Regarding Claim 44, the Examiner contends that the “*Davey* patent teaches conjugated and non-conjugated or coiling polymers that can be used as the coating polymer for the carbon nanotube (page 3, par. 0013 and 0016). Though the patent does not explicitly name the polymers, the polymers as recited in instant claim 44 are encompassed within the broad teaching of *Davey*. Therefore, one having ordinary skill in the art would have found it obvious to select polymers as claimed because these polymers are capable of coiling or forming strands or ropes as suggested by [the] *Davey*.” Office Action, at 4.

Regarding Claim 64, the Examiner contends that “[A]t page 7, paragraph 0060, the *Davey* patent teaches incorporation of the polymer-coated carbon nanotube in resins, polymer matrix and plastics to form various products. Therefore, based on this broad teaching of *Davey*, one having ordinary skill in the art would have found it obvious to select polymers as claimed because they are suitable as resins and plastics that form products suggested by *Davey* at page 7, paragraph 0060.” Office Action, at 4-5.

To establish a *prima facie* case of obviousness, under 35 U.S.C. § 103(a) three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of

success must both be found in the prior art and not based on applicant's disclosure. *See* M.P.E.P. 706.02(j); *see also In re Vaeck*, 947 F.2d 488, 20 U.S.P.Q.2d 1438 (Fed. Cir. 1991).

First of all, regarding Claims 44 and 64, *Davey* does not teach, disclose, or suggest single-wall carbon nanotubes nor does *Davey* teach, disclose, or suggest aggregates of single-wall carbon nanotubes. The arguments presented above contrasting single-wall carbon nanotubes with the multi-wall carbon nanotubes taught by *Davey* are also applied here.

Secondly, regarding Claims 44 and 64, *Davey* does not teach or suggest any of the specific polymers and copolymers cited in Claims 44 and 64. The Examiner's comments regarding Claims 44 and 64 suggest that these claims can be considered obvious even if there is no prior art reference that suggests the specific polymers and copolymers recited in these claims. This is clearly incorrect as a matter of law.

Pursuant to the third basic criteria noted above, a *prima facie* showing of obviousness requires the Examiner to provide a motivation or suggestion to combine or modify the prior art reference to make the claimed inventions. M.P.E.P. § 2142. The showings must be clear and particular and supported by objective evidence. *In re Lee*, 277 F.3d 1338, 1343, 61 U.S.P.Q.2d 1430, 1433-34 (Fed. Cir. 2002); *In re Kotzab*, 217 F.3d 1365, 1370, 55 U.S.P.Q.2d 1313, 1317 (Fed. Cir. 2000); *In re Dembiczak*, 50 U.S.P.Q.2d 1614, 1617 (Fed. Cir. 1999). Broad conclusory statements regarding a reference, standing alone, is not evidence. *Id.* And when an examiner (such as here) relies upon his or her own subjective opinion, this is insufficient to support a *prima facie* case of obviousness. *In re Lee*, 61 U.S.P.Q.2d 1430, 1434 (Fed. Cir. 2002). Consequently, the Examiner's motivation and opinions stated in the Office Action are insufficient to support a *prima facie* case of obviousness for rejecting Claims 46 and 64. *Id.* In fact, the Examiner's logic regarding these claims would render all claim limitations regarding chemical composition meaningless for patentability purposes, which is clearly not an accurate statement of the applicable law.

Therefore, as *Davey* does not teach, disclose, or suggest specific polymers and aggregates of single-wall carbon nanotubes as required by Claims 44 and 64, Claims 44 and 64 are not *prima facie* obvious.



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**PATENT**

In light of the foregoing, Applicant respectfully requests that the Examiner withdraw his rejection of Claims 44 and 64 under 35 U.S.C. § 103(a) as being unpatentable over *Davey* as applied to Claims 36-43, 45-59, 63 and 65 above and further in view of the Examiner's discussion.

**IV. CONCLUSION**

As a result of the foregoing, it is asserted by Applicant that the Claims in the Application are now in a condition for allowance, and respectfully requests allowance of such Claims.


Applicant respectfully requests that the Examiner call Applicant's attorney at the below listed number if the Examiner believes that such a discussion would be helpful in resolving any remaining problems.

Respectfully submitted,

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